CLAIMS

What is Claimed is:

1. A fuel processing system for producing hydrogen, said system comprising:

a primary reactor, said primary reactor disassociating hydrogen from a hydrocarbon fuel to generate a reformate gas including hydrogen and other by-products; and

a pressure swing adsorption (PSA) unit, said PSA unit being responsive to the reformate gas from the primary reactor and removing the by-products from the reformate gas to generate a nearly pure hydrogen gas, said PSA unit including an input port for receiving the reformate gas, a hydrogen output port for outputting the hydrogen gas and an exhaust output port for outputting the by-products, said PSA unit further including a rotating valve system having a rotary feed valve and a rotary product valve, a mass flow control device positioned in the hydrogen output port and a controller, said controller controlling the cycling speed of the rotary valves within the rotating valve system and the position of the mass flow control device so as to control the pressure within the hydrogen output port.

2. The system according to claim 1 wherein the PSA unit further includes a pressure sensor positioned within the hydrogen output port, said pressure sensor providing a pressure signal to the controller indicative of the pressure within the hydrogen output port, said controller controlling the cycling speed of the rotary valves within the rotating valve system and the position of the mass flow control device based on the pressure signal.

3. The system according to claim 2 wherein the controller employs a closed loop control algorithm with or without feed-forward control to provide the proper speed of the rotary valves and the proper position of the mass flow control device based on the pressure signal and a mass flow signal.

4. The system according to claim 1 wherein the controller employs an open loop algorithm including a look-up table to provide the proper speed of the rotary valves.

5. The system according to claim 1 wherein the PSA unit adsorbs carbon monoxide, carbon dioxide, water, nitrogen and methane as the by-products.

6. The system according to claim 1 wherein the PSA unit includes a plurality of vessels and wherein the rotating valve system cycles the vessels between pressurized and de-pressurized states.

7. The system according to claim 7 wherein the plurality of vessels operate in one of an adsorption, equalization, blow-down, purge or pressurization mode.

8. The system according to claim 1 wherein the fuel processing system is coupled to a fuel cell in a vehicle.

9. The system according to claim 1 wherein the fuel processing system is part of a hydrogen storage facility.

10. A gas purifying system for purifying a gas and outputting a purified gas, said system comprising:

an input port responsive to the gas to be purified;

a purified gas output port outputting the purified gas;

an exhaust gas port outputting unwanted by-products from the gas being purified;

a rotating valve system including a rotary product valve and a rotary feed valve, said valve system cycling vessels within the gas purifying system;

a mass flow control device positioned within the purified gas output port and controlling the flow of the purified gas therethrough; and

a controller, said controller controlling the speed of the rotary valves and the position of the mass flow control device so as to control the pressure within the purified gas output port.

11. The system according to claim 10 further comprising a pressure sensor positioned within the purified gas output port, said pressure sensor providing a pressure signal to the controller indicative of the pressure within the purified gas output port, said controller controlling the speed of the rotary valves and the position of the mass flow control device based on the pressure signal.

12. The system according to claim 11 wherein the controller employs a closed loop control algorithm including a look-up table to provide the proper speed of the rotary valves and position of the mass flow control device based on the pressure signal.

13. The system according to claim 10 wherein the controller employs an open loop algorithm including a look-up table to provide the proper speed of the rotary valves.

14. The system according to claim 10 wherein the purified gas is a hydrogen gas and the by-products include carbon monoxide, carbon dioxide, nitrogen, water and methane.

15. The system according to claim 10 wherein the gas purifying system is a pressure swing adsorption unit including a plurality of vessels, and wherein the rotating valve system cycles the pressurization of the vessels between adsorption, equalization, blow-down, purge and pressurization states.

16. A method for purifying a gas by removing by-products therefrom to generate a purified gas, said method comprising:

applying the gas to be purified to an input port of a pressure swing adsorber (PSA) unit;

outputting the purified gas through a purified gas output port of the PSA unit;

outputting the by-products through an exhaust gas output port of the PSA unit;

controlling the flow of the purified gas through the purified gas output port to control the pressure in the purified gas output port; and

controlling the speed of rotary valves in the PSA unit to control the pressure in the purified gas output port.

17. The method according to claim 16 further comprising sensing the pressure in the purified gas output port and controlling the speed of the rotary valves and the flow through the purified gas output port based on the sensed pressure.

18. The method according to claim 16 wherein controlling the speed of rotary valves includes controlling the cycling of a plurality of vessels in the PSA unit between high pressure and low pressure states.

19. The method according to claim 16 wherein the purified gas is hydrogen and the by-products include carbon monoxide, carbon dioxide, nitrogen, water and methane.

20. The method according to claim 19 wherein the purified hydrogen is provided to a fuel cell in a vehicle.